INVENTIONS & INNOVATION

Success Story

DUAL-FUEL CONVERSION SYSTEM FOR DIESEL ENGINES

A Fuel-Powered, Liquefied Natural Gas Conversion System for Diesel Engines Greatly Reduces Emissions

Diesel engines have been used for decades in industrial power generation, cogeneration power systems, locomotives, marine applications, and other engine markets. However, as tougher environmental standards are being enacted throughout industry, users of diesel engines are looking for ways to lower emissions without reducing engine power. Dual-fuel systems, engines that operate on more than one fuel source, are gaining popularity because they have the potential to reduce the amount of diesel fuel used. Until recently, adding a dual-fuel system was impractical because of the cost of replacing the original engine and the loss of power traditionally associated with these replacement systems.

Benefits

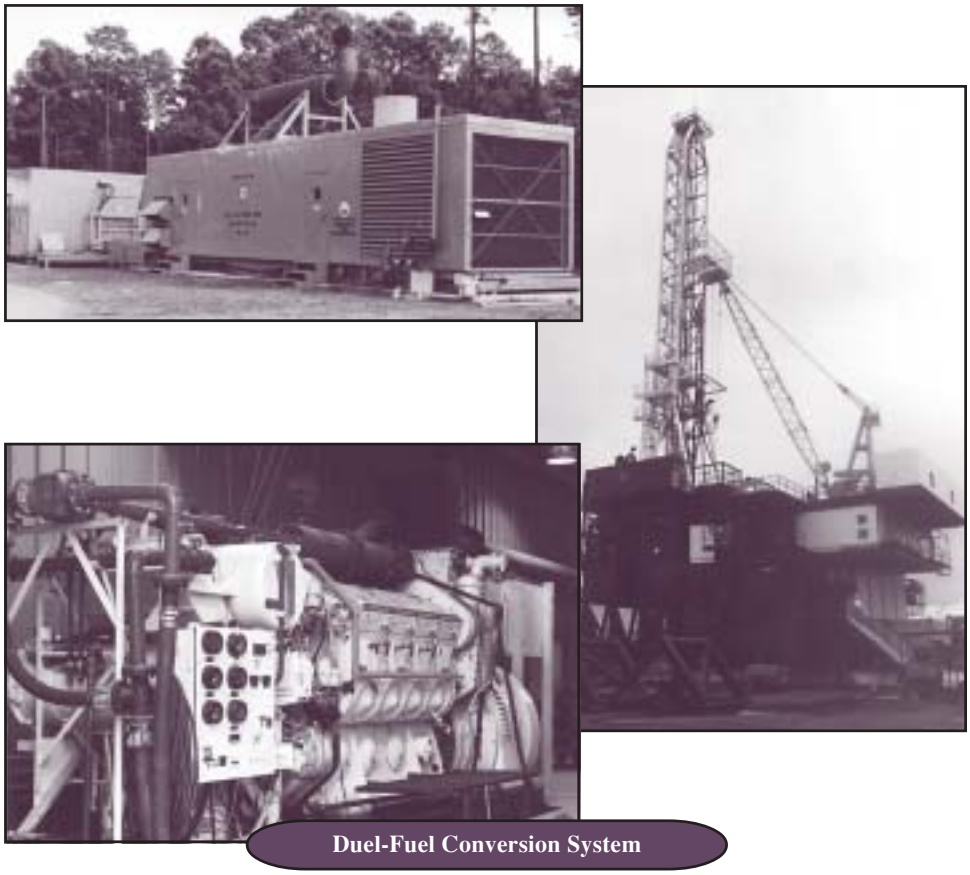
- Replaces nearly 90% of the imported diesel fuel normally required for engine operation with clean-burning domestically produced natural gas
- Adds functionality and value to user's original capital investment
- Reduces engine maintenance costs by using cleaner fuels that leave less carbon buildup
- Maintains original engine power while reducing emissions, such as particulates and nitrogen oxides (NO_x)
- Reduces refueling labor, and has a larger fuel storage so less frequent refueling is needed
- Retains the ability to run on 100% diesel fuel for cases in which natural gas availability and/or quality is inconsistent
- Addresses mandates for EPA's locomotive emissions standards set for 2002

Applications

This invention is targeted to benefit all industries that use diesel engines, such as offshore drilling and production, railroad locomotives, marine, and power generation.

Capabilities

This conversion system, which uses an alternative fuel with a readily available and abundant supply, maintains engine power, retains the flexibility to function on 100% diesel, and reduces emissions released into the atmosphere, especially particulates and NO_x.



Duel-Fuel Conversion System

Technology Description

With assistance from the U.S. Department of Energy's Inventions and Innovation Program, Energy Conversions, Inc. (ECI), has invented a dual-fuel conversion system that easily converts diesel engines into diesel-natural gas engines, eliminating the need for companies to replace their diesel engines with natural gas engines. ECI dual-fuel engine systems consist of specifically engineered pistons and heads, patented gas injectors, a supplemental cooling system, and ECI-engineered electronic controls. This system enables converted engines to operate on 90% natural gas while maintaining engine efficiency and fully rated horsepower. Dual-fuel operation is completely automated, requiring no user input. If a function falls out of normal operational limits, full diesel operation is activated instantly with no interruption of service.

Energy Savings and Pollution Prevention

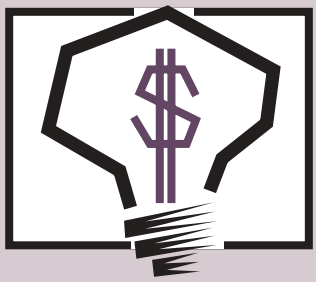
ECI dual-fuel systems substantially reduce emissions compared with unmodified counterparts, reducing NO_x emissions by 64% in locomotive applications, with further improvement in stationary power installations. Diesel particulate is also noticeably reduced. In addition, a natural gas engine requires much less maintenance and operates just as safely as a diesel or gasoline engine. It also reduces dependence on foreign supplied fuel sources by converting operation to an abundantly available domestic alternative. This product reduces NO_x emissions by over 51 tons per locomotive per year. Because of differences in duty cycles, power generator sets are estimated to provide even greater per-unit emissions savings.

System Economics and Market Potential

Burlington Northern has estimated that it could save $200 million a year in fuel purchases if it converted its entire locomotive fleet to natural gas. ECI conversion systems are currently saving one of its offshore drilling customers $4,000 per day in fuel costs with additional savings from the reduced cost of maintenance from burning a cleaner fuel. As of December 2000, a total of 20 systems have been sold for use in power generation, drill rig power, and locomotive applications. Orders for 8 more units are currently being filled in 2001.

Inventions and Innovation Program

The Inventions and Innovation Program provides financial assistance for establishing technical performance and conducting early development of innovative ideas and inventions. Ideas that have a significant energy-savings impact and future commercial market potential are chosen for financial support through a competitive solicitation process. Inventions funded by the program have saved enough energy to light 10 million homes per year. In addition, the program offers technical guidance and commercialization support to successful applicants. Ideas that benefit the Industries of the Future, designated by the Office of Industrial Technologies as the most energy-intensive industries in the United States, are especially encouraged.



"It takes a tremendous effort and tenacity to develop and promote products which have the potential to change industries – there are so many hurdles to get over. The I&I grant helped us to clear a significant hurdle during a stage of the project when we needed it the most."

–Paul Jensen
President
Energy Conversions, Inc.

For project information, contact:

Paul Jensen
Energy Conversions Inc.
6411 Pacific Highway East
Tacoma, WA 98424
Phone: (253) 922-6670
Fax: (253) 922-2258
pjensen@energyconversions.com

Home Page:
www.energyconversions.com

For more information about the Inventions and Innovation Program, contact:

Lisa Barnett
Program Manager
Inventions and Innovation Program
U.S. Department of Energy
1000 Independence Avenue SW
Washington, D.C. 20585-0121
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

Visit our home page at
www.oit.doe.gov

Order # I-OT-649
September 2001